

What is claimed is:

- 1 1. A method for restoring communications in a network,  
2 the network having a plurality of nodes, with each pair  
3 of nodes connected by a link, with each link having  
4 information channels and restoration channels,  
5 comprising the steps of:  
6     sending an idle signal on each restoration channel  
7 for each link;  
8     detecting a failure of a link connecting an  
9 originating node with a terminating node, said link  
10 having at least one information channel carrying  
11 information signals;  
12     determining an alternate path through the network  
13 for said information signals using restoration and idle  
14 signals sent over said restoration channels; and  
15     routing said information signals from said  
16 originating node to said terminating node in accordance  
17 with said alternate path.

1 2. The method of claim 1, wherein said step for  
2 determining said alternate path comprises the steps of:  
3 sending a restoration signal having a node  
4 identification number for said originating node in a  
5 restoration channel for each link connected to said  
6 originating node;  
7 sending a restoration signal having a node  
8 identification number for said terminating node in a  
9 restoration channel for each link connected to said  
10 terminating node; and  
11 routing said restoration signals through alternate  
12 links and at least one intermediate node until said  
13 restoration signal having a node identification number  
14 for said originating node reaches said terminating node,  
15 and said restoration signal having a node identification  
16 number for said terminating node reaches said  
17 originating node.

1 3. The method of claim 2, wherein said step of routing  
2 said restoration signals through said intermediate node  
3 comprises the steps of:  
4 a) receiving a first restoration signal over a  
5 first restoration channel for a first link at said  
6 intermediate node;  
7 b) sending said first restoration signal over a  
8 restoration channel for each link connected to said  
9 intermediate node except for said first restoration  
10 channel;  
11 c) receiving a second restoration signal over a  
12 second restoration channel for a second link at said  
13 intermediate node;  
14 d) determining whether said node identification  
15 number for said first restoration signal matches a said  
16 node identification number for said second restoration  
17 signal;  
18 e) sending an idle signal over said second  
19 restoration channel if said NIDs match;  
20 f) sending said second restoration signal over  
21 said first restoration channel if said NIDs do not  
22 match; and  
23 g) performing steps a) to f) for each  
24 intermediate node receiving a restoration signal.

1 4. The method of claim 3, further comprising the steps  
2 of:  
3 a) receiving a first idle signal over a  
4 restoration channel for a link connected to said  
5 intermediate node;  
6 b) sending a second idle signal over said  
7 restoration channel over which said first idle signal  
8 was received; and  
9 c) performing steps a) and b) for each  
10 intermediate node receiving an idle signal.  
11

1 5) The method of claim 4, further comprising the step  
2 of:  
3 a) receiving said restoration signal having a  
4 node identification number for said originating node  
5 over a link other than said failed link connected to  
6 said terminating node;  
7 b) disconnecting inputs for receiving said  
8 information signals from said failed links;  
9 c) connecting said inputs for receiving said  
10 information signals to said link over which said  
11 restoration signal was received by said terminating  
12 node; and  
13 d) sending an idle signal in all links connected  
14 to said terminating node except for said link over which  
15 said restoration signal was received by said terminating  
16 node.

1 6. The method of claim 5, further comprising the step  
2 of:  
3 a) receiving said restoration signal having a  
4 node identification number for said terminating node  
5 over a link other than said failed link connected to  
6 said originating node;  
7 b) disconnecting inputs for sending said  
8 information signals over said failed links;  
9 c) connecting said inputs for sending said  
10 information signals to said link over which said  
11 restoration signal was received by said originating  
12 node; and  
13 d) sending an idle signal in all links connected  
14 to said originating node except for said link over which  
15 said restoration signal was received by said originating  
16 node.

1 7. The method of claim 6, wherein said step for  
2 determining said alternate path is executed until at  
3 least one terminating condition is fulfilled from a  
4 group comprising: (1) all failed channels are restored;  
5 (2) there are no more available restoration channels on  
6 any link connected to one of said originating node and  
7 terminating node; (3) a predetermined delay period  
8 expires and a restoration signal is not received by one  
9 of said originating node and terminating node; and (4) a  
10 node receives a command from a central controller to  
11 halt restoration.

1 8. The method of claim 7, wherein said failed link has  
2 multiple information channels, further comprising the  
3 steps of:  
4 determining an alternate path through the network  
5 for information signals from each failed information  
6 channel using restoration and idle signals sent over  
7 available restoration channels for each link connected  
8 to said originating node;  
9 routing said information signals from said  
10 originating node to said terminating node in accordance  
11 with said alternate paths.

1 9. The method of claim 8, further comprising the steps  
2 of:  
3 repairing said failed link;  
4 receiving an idle signal at said originating node  
5 and said terminating node over said restoration channels  
6 for said repaired link;  
7 routing said information signals for said failed  
8 information channels from said alternate path of links  
9 and at least one intermediate node to said repaired  
10 information channels;  
11 sending an idle signal over said restoration  
12 channels for said alternate path of links and at least  
13 one intermediate node.

1 10. A method for restoring communications in a network,  
2 the network having a plurality of nodes, with each pair  
3 of nodes connected by a link, with each link having  
4 information channels and restoration channels,  
5 comprising the steps of:  
6 sending an idle signal on each restoration channel  
7 for each link;  
8 detecting a failure of an intermediate node between  
9 an originating node and a terminating node, said  
10 intermediate node switching information signals carried  
11 by at least one information channel for a plurality of  
12 links terminating at said intermediate node and carrying  
13 information signals from said originating node to said  
14 terminating node;  
15 determining an alternate path through the network  
16 around said failed node using restoration and idle  
17 signals sent over restoration channels for links not  
18 terminating at said failed node; and  
19 routing said information signals from said  
20 originating node to said terminating node in accordance  
21 with said alternate path.

- 1 11. The method of claim 10, wherein said step for
- 2 determining comprises the steps of:
- 3 identifying information channels for nodes having
- 4 links terminating at said failed node;
- 5 ranking said nodes using a connection map;
- 6 sequentially restoring said information channels
- 7 for nodes having links terminating at said failed node
- 8 according to said rankings until all said information
- 9 channels are restored.